2007

New York Harbor Water Quality Report

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Michael R. Bloomberg,
Mayor
Emily Lloyd,
Commissioner

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New York Harbor Water Quality Report

The 2007 *Harbor Water Quality Report* shows once again that New York Harbor is at its cleanest in well over a century. Key indicators confirm that the Harbor's critical ecosystems are flourishing, and that that we have made consistent gains in overall aquatic health.

Our Administration, led by the New York City Department of Environmental Protection, is working towards even greater progress, especially as we reclaim New York City's waterfront areas. In fact, a key component of PlaNYC's strategic vision for the City's future is ensuring that 90% of our waterways are available for recreational purposes by 2030. From fishing and boating, to swimming and water sports, these activities will mean that New Yorkers are able to fully enjoy the beautiful waterways that have defined our City's history and growth for centuries.

Improving the quality of our City's waterways is an important factor in building a greener, greater New York. I encourage all New Yorkers to review this detailed account of New York Harbor's biological health in order to appreciate the dramatic improvements in water quality we've made in recent decades, and to learn more about the many projects that will lead to further improvements in the years to come.

Sincerely,
Michael R. Bloomberg
Mayor

The 2007 *Harbor Water Quality Report* marks the 98th year of comprehensive water quality and reflects continued improvements to the health and vitality of New York's waterways. This continued progress attests to the success of the New York City Department of Environmental Protection's extensive pollution control programs and comprehensive upgrades to our wastewater treatment and stormwater management infrastructure.

Despite these successes, combined sewer overflows (CSOs) continue to impact the Harbor's aquatic health. DEP's Capital Investment Strategy calls for continued upgrades to wastewater treatment facilities, storm sewer expansions and the construction of several large CSO retention tanks to further mitigate this chronic source of pollution, but ultimately, DEP is working to supplement this extensive infrastructure and further enhance CSO capture rates with innovative and sustainable stormwater management techniques, known as best management practices.

Already, DEP is piloting several of the most promising management practices, using mussel beds to naturally filter water in Jamaica Bay, testing green roofs at several buildings citywide, and distributing rain barrels to more than a thousand city residents. These pilots will guide our future stormwater management policy and ensure that we are able to develop the citywide strategies that will allow us to meet the water quality goals set by Mayor Bloomberg as part of his PlaNYC initiative and open 90% of New York's waterways to recreation by the year 2030.

DEP is proud of the consistent improvements to aquatic health in New York's Harbor, and we hope that you will find this report useful and informative. We appreciate your interest in our continuing efforts to enhance the health of New York City's iconic waterways.

Sincerely,
Emily Lloyd,
Commissioner

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Introduction

The City of New York has been collecting water quality data in New York Harbor since 1909. These data are utilized by regulators, scientists, educators and citizens to assess impacts, trends and improvements in the water quality of New York Harbor.

The Harbor Survey Program has been the responsibility of the New York City Department of Environmental Protection's (NYC DEP) Marine Sciences Section (MSS) for the past 24 years. This effort evolved from the initial surveys by the Metropolitan Sewerage Commission that began 99 years ago and encompassed 12 stations around Manhattan. These initial surveys were performed in response to public complaints about their quality of life near polluted waterways. The initial effort has grown into a Survey that consists of 52 stations; 35 stations located throughout the open waters of the harbor, and 17 stations located in smaller tributaries within the City. The number of water quality parameters measured has also increased from five in 1909 to over 20 at present.

Harbor water quality has improved dramatically since the initial surveys. Infrastructure improvements and the capture and treatment of virtually all sewage that was dumped into the harbor are the primary reasons for this improvement. During the last decade, water quality in NY Harbor has improved to the point that the waters are now utilized for recreation and commerce throughout the year. These improvements in water quality have brought attention to areas within the harbor that remain impaired.

The NYC DEP's Long Term Control Program (LTCP) has begun to focus on those areas within the harbor that remain impacted. This project will look at 18 waterbodies and their drainage basins and will develop a comprehensive plan for each waterbody to attain its best use classification.

This year's report will focus on the water quality data collected by the NYC DEP during 2007. Data will be presented in four sections, each delineating a geographic region within the harbor. Four water quality parameters will be used as indicators of water quality for this report. The four parameters are: fecal coliform bacteria, Chlorophyll 'a', dissolved oxygen and Secchi transparency. These parameters and their relevance are explained in a subsequent synopsis.

The Harbor Survey program has modified its sampling program over the last several years. The number of open water stations sampled has been reduced from fifty-three to thirty-five. The statistics presented in this report reflect comparisons with only the current Harbor Survey stations.

This brief synopsis examines trends of four major indicators of environmental change in the Harbor Estuary. These four indicators are:

Fecal Coliform (FC) Bacteria - Fecal coliform concentrations are measured in NY Harbor as human-health related indicators of sewage-related pollution. Fecal coliform are a group of bacteria primarily found in human and animal intestines and are associated with sewage waste. These bacteria are widely used as indicator organisms to show the presence of such wastes in water and the possible presence of pathogenic (disease-producing) bacteria.

Chlorophyll 'a' - Chlorophyll 'a' is a plant pigment. The concentration of Chlorophyll 'a' in water is used as an estimate of productivity or phytoplankton abundance.

Phytoplankton, minute free-floating aquatic plants, form the basis of the food web. Since these organisms respond quickly to environmental changes, their abundance may serve as a measure of water quality and an indicator of greater ecosystem change.

The Harbor Survey measures Chlorophyll 'a' (as a surrogate for phytoplankton) to provide an assessment of ecosystem health. Levels above 20 ug/L are considered indicative of enriched or eutrophic conditions, indicating a decline in water quality.

Dissolved Oxygen (DO) - The levels of oxygen dissolved in the water column are critical for respiration of most aquatic life forms, including fish and invertebrates, such as crabs, clams, zooplankton, etc. Dissolved oxygen concentration is therefore, one of the most universal indicators of overall water quality and a means of determining habitat and ecosystem conditions.

Secchi Transparency - A Secchi disk is used to estimate the clarity of surface waters. High Secchi transparency (greater than 5.0 feet) is indicative of clear water, with declines in transparency typically due to high suspended solid concentrations or plankton blooms. Low Secchi readings (less than 3.0 feet) are typically associated with degraded waters. These conditions are indicative of light limiting conditions, which in turn affect primary productivity and nutrient cycling.

Coliform and dissolved oxygen indicators are used in New York State Department of Environmental Conservation (NYSDEC) standards, to quantify ecosystem health or degradation. NYSDEC standards reflect a range of acceptable water quality conditions corresponding to the State-designated "best usage" of the water body. Common uses and NYSDEC standards for fecal coliform and dissolved oxygen are noted in the adjacent chart.

Common Water Use And NYS DEC Standards For Fresh And Saline Waters

Class	Best Usage of Waters	Fecal Coliform	Dissolved Oxygen (never-less-than)
SA	Shellfishing and all other recreational use.	No standard	5.0 mg/L
SB	Bathing and other recreational use	Monthly geometric mean less than or equal to 200 cells/100 mL from 5 or more samples	5.0 mg/L
I	Fishing or boating	Monthly geometric mean less than or equal to 2,000 cells/100 mL from 5 or more samples	4.0 mg/L
SD	Fish survival	No standard	3.0 mg/L

Inner Harbor Area

The Inner Harbor is defined as the area including: the Hudson River from the NYC-Westchester line, through the Battery to the Verrazano Narrows; the Lower East River to the Battery; and the Kill Van Kull-Arthur Kill system. This area contains 13 Harbor Survey monitoring stations that have been grouped together due to common water uses and functions, as well as similarities in point source loadings. Waters of the Inner Harbor are often continuous, through connecting branches or straits, and cover a large and diverse geographic expanse.

Most of the Inner Harbor Area, excluding the Kills, is classified by NYSDEC as I, for uses such as fishing or boating. Most area in the Kills is classified for fish survival only (SD), with the exception of the far southern reach of Arthur Kill which is designated as Class I. The Hudson River, from North of Spuyten Duyvil to Westchester County is designated for bathing (SB).

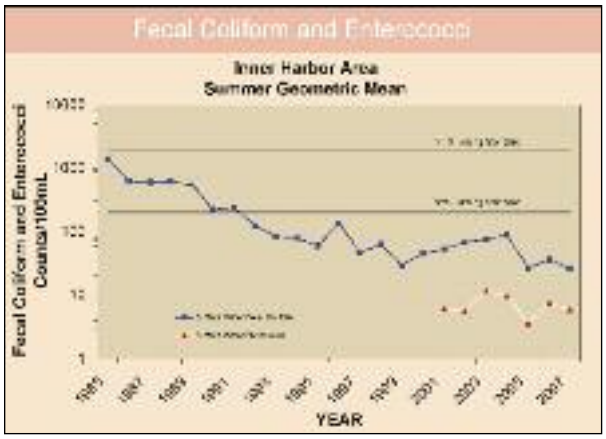
Fecal Coliform

Sanitary water quality as estimated by fecal coliform (FC) concentrations was superior for the Inner Harbor in the summer of 2007. The regional summer mean is 26 cells/100 mL, decreased slightly from 36 cells/100 mL in 2006. All Inner Harbor Area monitoring sites complied with monthly FC Standards of 200 cells/100 mL. Only one site had geometric means greater than 100 cells/100 mL.

Past data has indicated that the Inner Harbor is prone to episodic degradation following rain events due to additional FC loadings from storm drains and combined sewer overflows (CSOs). Under these conditions, all sites exceeded the SB standard 200 cells/100 mL. Note: Wet Weather advisories for beaches in this region may still be issued by NYCDOH under certain conditions.

Trends

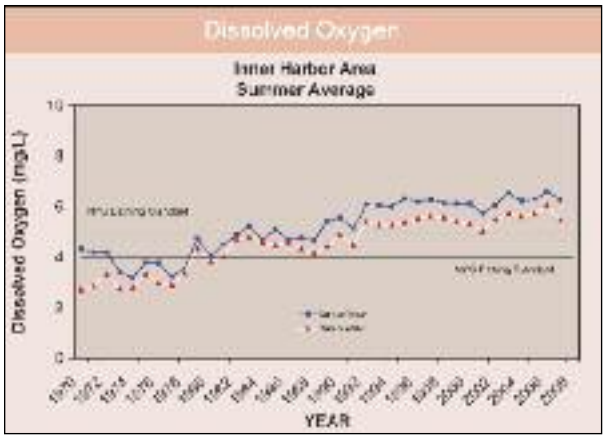
Fecal coliform levels in the Inner Harbor have dramatically declined over the last three decades. However, there had been a gradual increase in 1999 to 2004, but the levels were still below the bathing standard. The averaged FC counts have declined from 2000 cells/100 mL in the early '70s to below 100 cells/100 mL since early 1990. This improvement has allowed for the opening of Inner Harbor waters for most recreational activities. This improvement has been attributed to the cessation of raw sewage from New York City's Water Pollution Control Plants (WPCPs), the elimination of illegal discharges into the waterbody, and the reduction of CSOs. Year to year variations have become more apparent with the reduction of FC to levels below standards.



Dissolved Oxygen

Average dissolved oxygen (DO) values decreased from 2006 values. Summer DO values averaged 6.3 mg/L for surface waters and 5.5 mg/L for bottom waters, down from 2006 values of 6.6 mg/L and 6.1 mg/L.

Discrete DO measurements of surface waters failed to comply with NYSDEC standards 2% of the time, up from 1% of the time. Discrete DO measurements of bottom waters failed to comply with NYSDEC standards 5% of the time, up from 3% of the time.



Trends

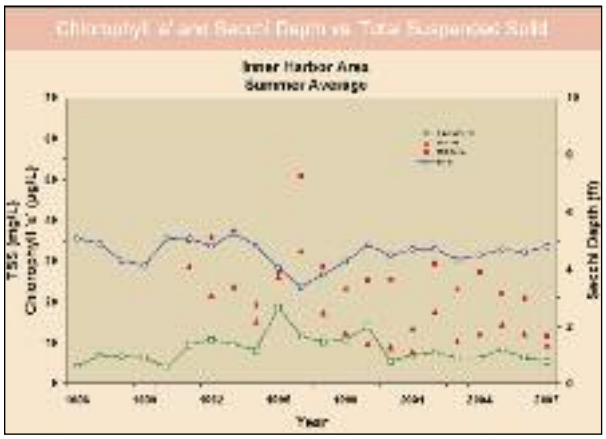
Average summer DO values in the Inner Harbor have risen to levels above NYSDEC standards for primary contact recreation and commercial fisheries. Bottom water values have risen from approximately 3.0 mg/L in 1970 to 5.5 mg/L at present. The mitigation of impacts from the WPCPs and CSOs has shown that swings in DO may be due to natural phenomena such as weather.

Inner Harbor Area

Chlorophyll 'a'

While water quality standards do not exist for Chlorophyll 'a', concentrations in excess of 20 ug/L are considered indicative of eutrophic conditions. All stations within the Inner Harbor area had average summer Chlorophyll 'a' values below the 20 ug/L level. In fact all but one station at Tottenville had summer averages <10 ug/L (K5 averaged 10.2 ug/L). This follows the same trend as the past two years where this location has the highest Chlorophyll 'a' average in this region; K5 at Tottenville had averaged 13.6 ug/L in 2005 and 17.8 ug/L in 2006.

Typical patterns within the summer season show higher Chlorophyll 'a' concentrations in June and July than in August and September. Some areas, such as Hudson River, Gowanus Bay and Tottenville, showed high maximum concentrations in early summer which tapered off by Labor Day. For example, discrete samples in Gowanus Bay peaked at a maximum of 47.36 ug/L in July (mean was 18.34 ug/L), but showed a maximum of only 6.89 ug/L in September (mean was 3.27 ug/L).

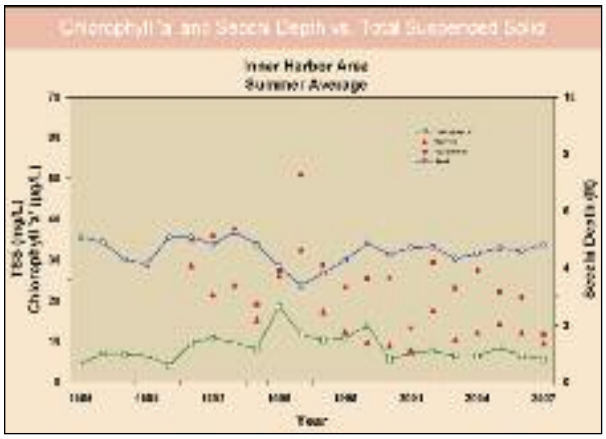


Trends

The Inner Harbor shows the least inter-annual variability in Chlorophyll 'a' concentrations. As the figure shows, the Chlorophyll 'a' average in this region has remained fairly constant and under 10 ug/L since 2000. One suspected reason for this is the enormous amount of water flowing in the region from the Hudson River.

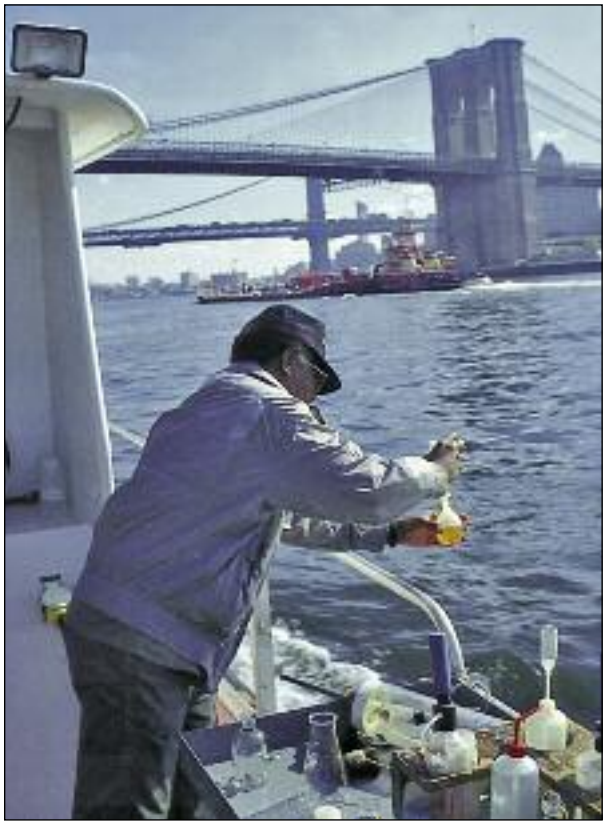
Secchi Transparency

No water quality standards exist for the Secchi transparency. In general, high Secchi numbers (depths of five feet or greater) are associated with clearer water, while low Secchi numbers (depths of three feet or less) are indicative of turbid (or light limiting) conditions. In summer 2007, average Secchi reading was 4.8 feet in the Inner Harbor area. The average values for the thirteen stations were between 3.2 - 6.7 feet. Out of a total of 200 samples, Secchi values ranged from 1.5 - 3.0 feet (40 times, most of them at N3B) to a high of 5.0 -10.0 feet (100 times, highest at G2).

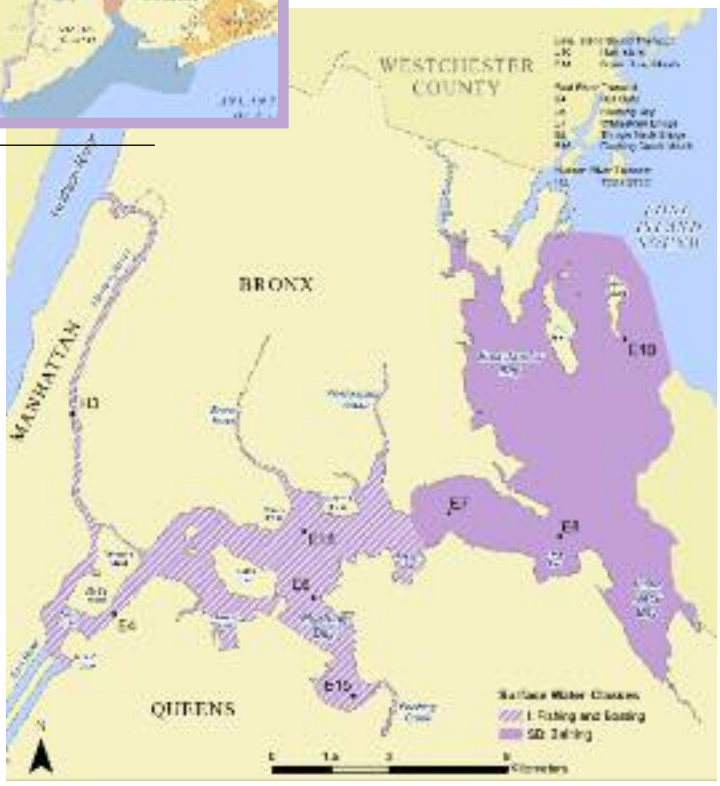


Trends

Average summer Secchi values have remained relatively constant (>4.0 feet) in the Inner Harbor area since measurements began in 1986, except around 1990 (1996 and 1997). There have been only a couple of percent variations over the past 21 years. This can most likely be attributed to the normal flow from the Hudson River.



Upper East River–Western Long Island Sound

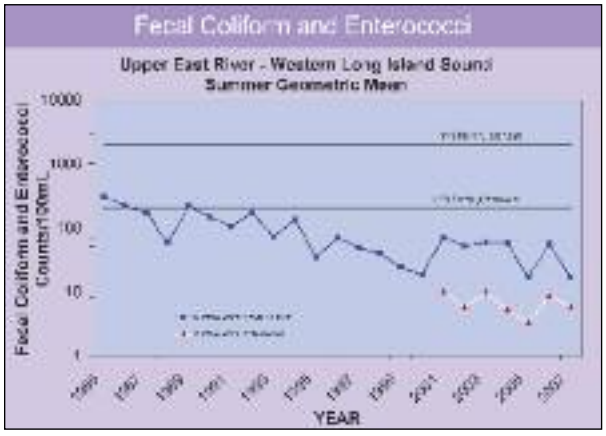


The Upper East River-Western Long Island Sound (UER-WLIS) represents the north-eastern portion of NY Harbor, from Hell Gate in the East River, up into the Western Long Island Sound (WLIS). ***The Harbor Survey Program*** *provides coverage of this area, including the Harlem River and the East River, from Roosevelt Island to Hart Island at the NYC-Westchester County boundary. This area contains eight Harbor Survey monitoring stations. Waters of this vicinity, though divergent in salinity and depth, share similarities in pollutant loadings and are targeted for intensive management efforts as part of the* ***Long Island Sound National Estuary Program.***

The majority of the Upper East River-Western Long Island Sound complex is classified as I, for uses such as fishing or boating, with the area east of the Bronx-Whitestone Bridge designated for bathing (SB).

Fecal Coliform

In 2007, sanitary water quality continued to be superior for Upper East River-Western Long Island Sound. Fecal coliform (FC) concentrations for all monitoring sites were in compliance with their specified best use classifications for bathing and fishing. The summer geometric mean for this region was 17 cells/100 mL, down from 55 cells/100 mL in 2006. All sites had summer geometric means less than 50 cells/100 mL.



Trends

Fecal coliform concentrations have shown a downward trend for more than twenty years in the Upper East River-Western Long Island Sound (UER-WLIS) region. This improvement, measuring about two orders of magnitude, indicates FC concentrations met standards suitable for bathing 96% of the time over the past 15 years. The ongoing upgrade of wastewater treatment facilities and improved control of flow regulators and combined sewer overflow events have had, and will continue to have, a major impact on the reduction of fecal coliform loads.

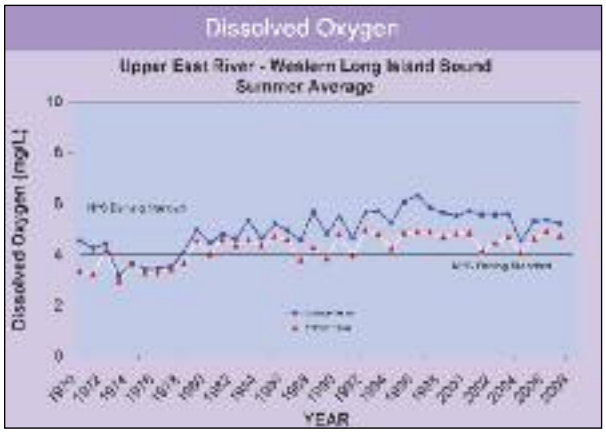
Dissolved Oxygen

Average summer DO values for the Upper East River and Western long Island Sound vicinity met and exceeded 4.0 mg/L (conditions suitable for fishing) in surface waters at all sites. Average values for bottom waters at the three stations designated as SB (stations E7, E8 and E10) were below the 5.0 mg/L NYSDEC standard for bathing use.

UER-WLIS were problem areas during the summer of 2007, although long-term trends remain positive. Average DO levels were near ten-year highs. Yet, 2007 DO levels in the UER-WLIS show high numbers of non-compliance incidents with NYSDEC standards. Discrete DO measurements of surface and bottom waters failed to comply with the standards 25% and 39% of the time for surface and bottom waters, respectively. Non-compliance incidents in both surface and bottom waters were 42% and 50% in 2004, 29% and 38% in 2005, 17% and 30% in 2006.

2007 DO levels in the Upper East River and Western Long Island Sound are the lowest throughout the harbor. Summer DO averaged 5.2 mg/L and 4.7 mg/L for surface and bottom waters, slightly lower than 5.3 mg/L and 4.9 mg/L in 2006.

Incidents of hypoxia (DO <3.0 mg/L) were measured in bottom waters at stations E10 and E8, from July 24 through August 20. Minimum DO levels were recorded on August 6. A similar number of hypoxia events were recorded over the same dates in 2007 compared with 2006.



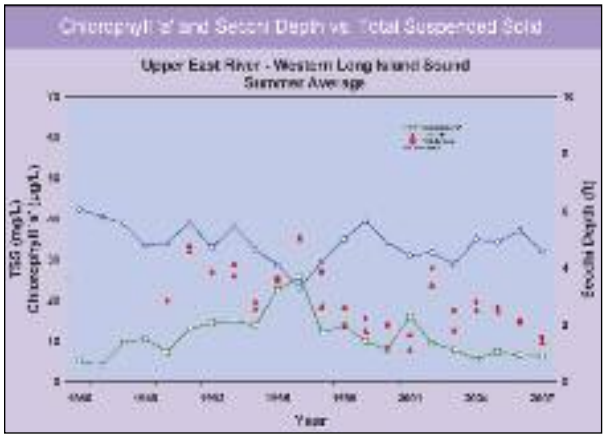
Trends

Since 1970, trend analysis for the UER-WLIS area shows an increase in DO of about 1.5 mg/L for surface waters and 2.0 mg/L for bottom water. Most notable are improvements in bottom waters that have risen from well below fishable (4.0 mg/L) to close to bathing standards (5.0 mg/L). Trends, however, also demonstrate high DO variability, with an increasing gap between surface and bottom water improvements since the mid-1980s. This suggests the formation of two separate water masses or pronounced stratification. In the WLIS in particular, conditions symptomatic of eutrophic waters have been observed since the late 1980s. These conditions include extremely high surface water DO (often associated with algae blooms) and sporadic, but extremely low, bottom DO. This decline in water quality is being addressed by the Long Island Sound Study.

Upper East River–Western Long Island Sound

Chlorophyll 'a'

Chlorophyll 'a' concentrations for the Upper East River-Western Long Island Sound have been declining slightly over the last three years. The 2007 summer average of 6.40 ug/L is the second lowest average in the last 20 years. As in the Inner Harbor region, all stations here had average summer Chlorophyll 'a' values below 20 ug/L with all but two (E15 and E10) below 10 ug/L. The E15 station is located at the head of Flushing Bay adjacent to the World's Fair Marina and was added to the Harbor Survey in 2006 after being absent from the survey since 1999. Chlorophyll 'a' here will likely be higher than in most of the region due to the station's limited tidal exchange and proximity to Flushing Creek.

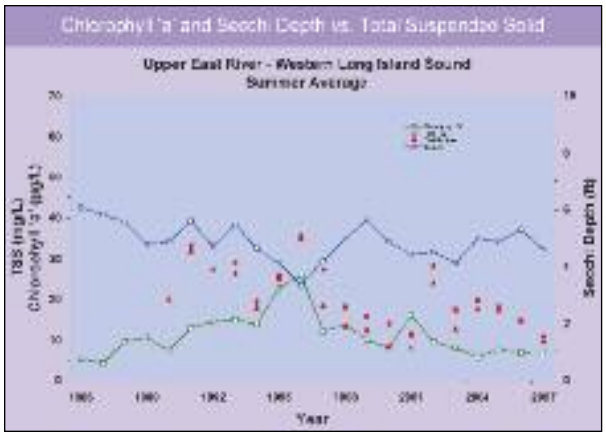


Trends

Long-term trends for Chlorophyll 'a' in this region show summer averages in the 6-16 ug/L range dating back to 1986 (see figure). The two exceptions being 1995 and 1996 where concentrations averaged 22.8 ug/L and 25.8 ug/L respectively. Furthermore, for the past six years the summer average has been less than 10 ug/L.

Secchi Transparency

In summer 2007, average Secchi transparencies for two of all eight stations were >5.0 feet (E7 and E8). A total of 67 out of 131 readings were >5.0 feet, with E7 having the highest value of 8.0 feet on August 27th. Lower readings (1.5 - 2.0 feet) were observed mostly in Flushing Creek (E15) 6 times, East 155 St., Harlem River (H3) 3 times and Flushing Bay (E6), and Hart Island (E10) 1 time each.



Trends

For UER-WLIS stations as a group, the Secchi transparency has varied between about 4.0 and 6.0 feet since 1986. The transparency once dropped to 3.3 feet in 1996, but climbed back. Improved Secchi transparency depths may coincide with a significant decrease in Chlorophyll 'a' since 1996 for the same waters.

Jamaica Bay

Jamaica Bay is located at the southwestern end of Long Island. This urban, estuarine embayment and national park consists primarily of tidal wetlands, upland areas, and open waters. The Bay and its drainage area are almost entirely within the boroughs of Brooklyn and Queens, except for a small area at the eastern end that is in Nassau County. Jamaica Bay joins the New York Harbor to the west, via the Rockaway Inlet at the tip of Breezy Point and includes the Rockaway Peninsula, which forms the southern limit of the Bay and separates it from the Atlantic Ocean. This estuarine water body, consisting of approximately 20 square miles of open water, is covered by nine Harbor Survey monitoring stations.

Open waters of Jamaica Bay are classified for bathing or other recreational use (SB). Areas within the Bay's tributaries and dead-end canals are prone to reduced water quality due to direct surface runoff and poor flushing. These areas are designated for secondary contact use (I), such as fishing or boating.

Fecal Coliform

In 2007, sanitary water quality was superior for Jamaica Bay, with summer fecal coliform (FC) concentrations below 200 cells/100 mL, the SB standard for all stations.

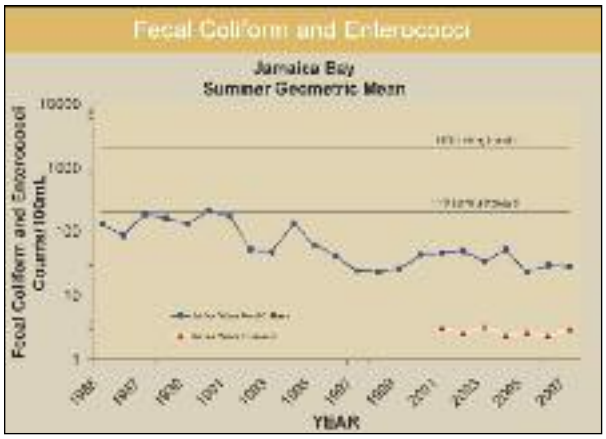
Five of nine sites had geometric means below 50 cells/100 mL. Two stations' geometric means were less than 20 cells/100 mL (an order of magnitude below State standards).

Under wet weather conditions, the bay experiences localized degradation. At these times, spikes in FC may temporarily exceed the SB standard of 200 cells/100 mL for the entire northern portion of the Bay (from Mill Basin to Bergen Basin). This decrease in water quality is limited to the Bay proper, as Lower NY Bay waters (immediately outside the mouth of Jamaica Bay) are not typically affected by wet weather events.

Trends

Mean FC levels in Jamaica Bay as a whole have been at or below 200 cells/100 mL State standard for bathing over the past 20 years. FC levels peaked at 200 cells/100 mL in 1990, reached a low of 23 cells/100 mL in 1998, and have since increased to 28 cells/100 mL.

The DEP continues to improve sewage system operations. Design and construction of CSO storage tanks continues in several Jamaica Bay tributaries. Additionally, DEP skimmer vessels work to control floatable debris in Jamaica Bay as part of the "Boom and Skim" program.



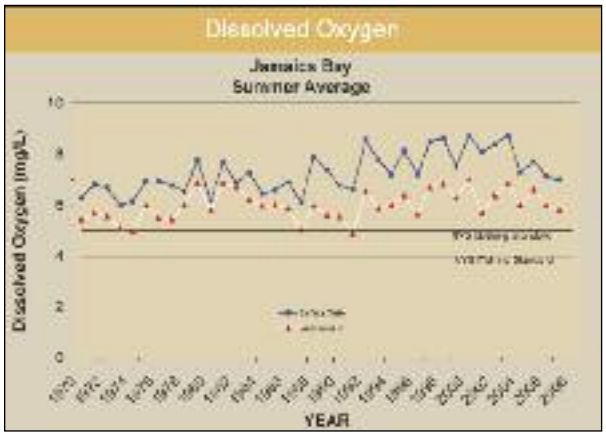
Dissolved Oxygen

The 2007 summer averages for dissolved oxygen (DO) for surface and bottom waters surpassed the New York State standard of 5.0 mg/L for bathing (SB) at all stations except for bottom waters at station J12 (Grassy Bay).

Individual measurements failed to comply with NYSDEC standards in 50 of 234 measurements. Several hypoxia events (DO<3.0 mg/L) were recorded at 2 of 9 stations, most frequently at northeastern-most station J12 (Grassy Bay).

Trends

Average DO levels were well above 5.0 mg/L Bathing standard as early as 1970. DO variability is high within and between years and the gap between surface and bottom waters has been increasing since the mid-1980s. High surface DO levels are often due to supersaturated conditions attributable to algae blooms and eutrophic waters.



Jamaica Bay

Chlorophyll 'a'

For the first time in 17 years the summer Chlorophyll 'a' average in Jamaica Bay is below 30 ug/L (see figure). Though this region typically has higher averages than any other city waters, the 2007 average of 23.7 ug/L is almost a 40% reduction from 2006 (37.82 ug/L). The highest average concentrations were recorded in the northeastern areas of the bay with maximum discrete samples at stations J2, J3 and J7 exceeding 120 ug/L. The high concentrations here are indicative of eutrophic conditions. Slow turnover of water within the bay and nutrient rich tributaries feeding it allow for development of large standing phytoplankton populations.

Within a sampling year, Chlorophyll 'a' concentrations tend to decrease as the summer wears on. For example, from June to September in 2007, the monthly average in July spiked to 41.1 ug/L from 32.6 ug/L in

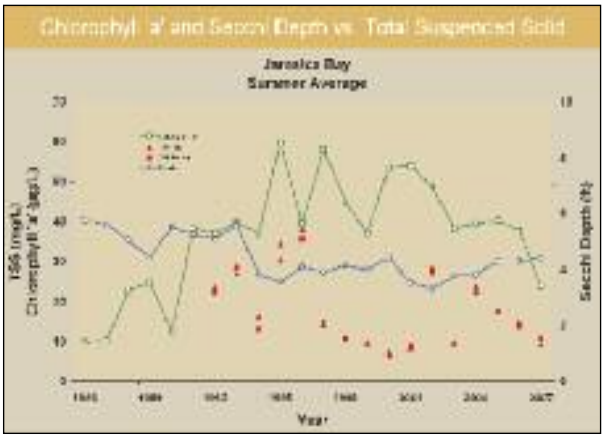
June and then settled down to 12.1 ug/L and 9.0 ug/L in the final two months of the summer. There were similar trends in 2005 and 2006. One can speculate that phytoplankton are abundant in the beginning of the summer and the blooms die off with the warming waters.

Trends

Chlorophyll 'a' summer averages in Jamaica Bay were less than 25 ug/L before 1990. The values jumped to 38.3 ug/L in 1991 and have remained above 36 ug/L up until 2007. Very high average values can be found in the middle 1990s (1995, 1997) and early 2000s (2000-2002). These conditions have coincided with prolonged algae blooms in Jamaica Bay and reports of nuisance algae in the tributaries and canals. Time will tell if this year's lower average is an outlier or a declining trend.

Secchi Transparency

The Secchi transparencies range from 2.0 to 11.0 feet in the Jamaica Bay area. Three stations (J1, J11and J5) had average readings above 5.0 feet (depths associated with cleaner waters). Two of the three sites are located outside the Bay proper and experience greater water exchange than sites within the Bay. Average Secchi values for interior Bay survey sites ranged from 3.7 to 6.8 feet. Inside Jamaica Bay, the lowest Secchi readings (2.0 feet) were recorded on July 10 at (J7), associated with higher Chlorophyll 'a' and pH measurements.



Trends

The Secchi transparency depth decreases as Chlorophyll 'a' levels increase. Secchi average depths greater than 5.0 feet were typical before 1993. After that year, the average depths stayed between 3.5 to 4.0 feet. For the last three years, average Secchi transparency depths were between 4.3 - 4.4 feet.

Lower New York Bay–Raritan Bay

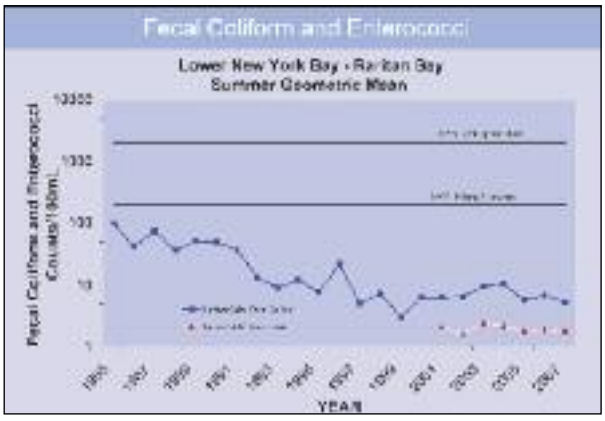
The Lower NY Bay-Raritan Bay (LNYB-RB) vicinity represents the most oceanic portion of the ***Harbor Survey Program.*** *This area of 100 square miles is represented by five Harbor Survey monitoring stations and is composed mostly of open shallow waters, partially confined by Brooklyn's Coney Island to the north, Staten Island to the northwest, and New Jersey's Middlesex and Monmouth counties and Sandy Hook to the south. The remainder of its eastern boundary is open to Rockaway Inlet and the greater Atlantic Ocean.*

This area of the Harbor is classified for bathing and other recreational use (SB). Portions of those waters are also designated for the permitted use of shellfishing (for relay to cleaner waters, but not direct consumption), having a stricter use classification of SA.

Fecal Coliform

In 2007, sanitary water quality as estimated by fecal coliform (FC) was superior for the Lower New York Bay-Raritan Bay (LNYB-RB) compared to other waterbodies.

Summer averages FC numbers show waters of the LNYB-RB meet and surpass NYS standards for this area. All five Stations had geometric means less than 20 cells/100 mL (an order of magnitude below State standards).



Trends

Fecal Coliform (FC) concentrations for LNYB-RB show significant declines (more than an order of magnitude) from the mid-1980s to the present time. While FC concentrations for surface waters were always below 200 cells/100 mL, recent average FC levels in 1999 were 3 cells/100 mL. Levels have increased to 10 cells/100 mL since 1999.

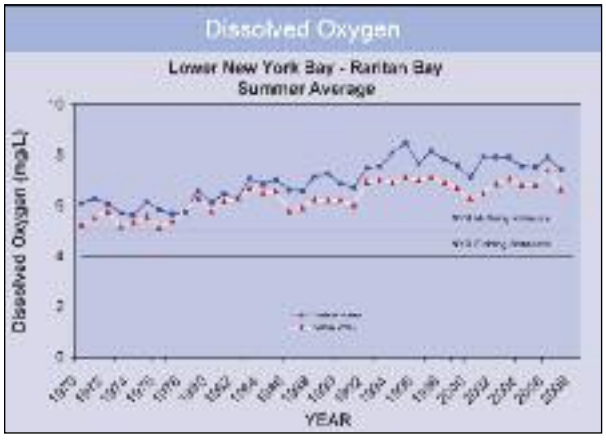
These improvements have allowed for the opening of all NYC public beaches since 1992 and the lifting of wet weather swimming advisories.

Dissolved Oxygen

Dissolved Oxygen (DO) values for top and bottom waters show good compliance with the NYS DO standard of 5.0 mg/L. Average DO values failed to comply with State standards at a single station (K5A). Actual DO values were found to be below 5.0 mg/L four times out of 125 measurements and minimum DO values were below 4.0 mg/L only at bottom waters of station K5A. This is true despite K5A's proximity to more degraded waters in the Arthur Kill, Narrows, and mouth of Jamaica Bay.

Trends

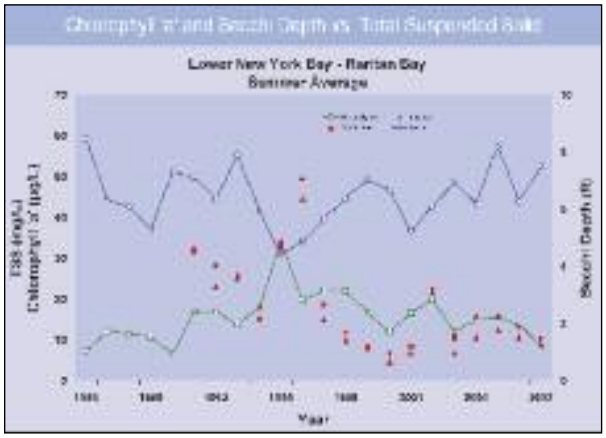
Since 1970, average DO concentrations have increased 1.3 mg/L from 6.1 to 7.4 mg/L for surface waters, and from 5.2 to 6.7 mg/L for bottom waters. Most of the improvement in the LNYB-RB area is attributed to improved water quality at station K5A. This improvement reflects loading decreases in sanitary waste into Arthur Kill and the Raritan River.



Lower New York Bay–Raritan Bay

Chlorophyll 'a'

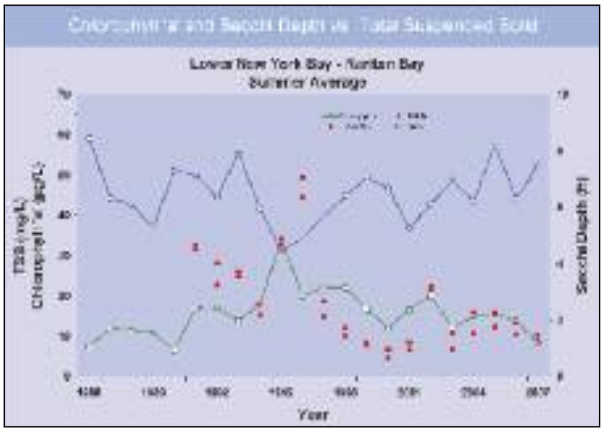
The Lower New York Bay region is the largest discussed in this report, yet it is only represented by five stations. The three stations in the eastern side of this region (Lower Bay) usually have very low average Chlorophyll 'a' concentrations. In 2007 all three averages were ≤4 ug/L. These waters are among the clearest in the city and are represented by sampling stations at the Verrazano Narrows, Coney Island Beach and Rockaway Inlet. Raritan Bay however, has higher concentrations (average of 20.4 ug/L at K6) possibly due to its shallow, slower-moving water where nutrient-rich harbor waters empty into the bay. This physical arrangement seems ideal for phytoplankton bloom (algae slicks) formation. Contact with nutrient-rich oceanic waters only further serves to fuel additional phytoplankton growth until slicks are dispersed again or washed out of the area.



Trends

Average summer Chlorophyll 'a' concentrations for the Lower New York Bay-Raritan Bay (LNYB-RB) area remained at or below 20 ug/L for the past 22 years, except for three years (1995, 1997, 1998). In 2007, the average Chlorophyll 'a' measurement was 8.40 ug/L.

Secchi Transparency



Average Secchi values for LNYB-RB stations were all above 5.0 feet at stations N8, N9, and N16. As usual, a highest average value of 12.4 feet was located at Rockaway Point (N16). This site, the most oceanic of the Harbor Survey's 35 monitoring stations, commonly experiences the widest range in Secchi values. In 2007, measurements at N16 ranged from 7.0 to 17.0 feet. Levels above 5.0 feet indicate clean conditions and superior water quality. At this region, 17 out of 70 Secchi readings were below 5.0 feet. The lowest reading of 2.5 feet was recorded at K5A on June 20.

Trends

While group average values for the LNYB-RB stations are typically 1.0 to 2.0 feet higher than those of Jamaica Bay, Secchi trends show similar patterns for both waterbodies.

Averages of Secchi transparency in LNYB-RB have remained above 5.0 feet since 1986 with exceptions of 1995 and 1996. The drop coincided with the big jump of Chlorophyll 'a' in 1995.

Harbor-Wide Improvements

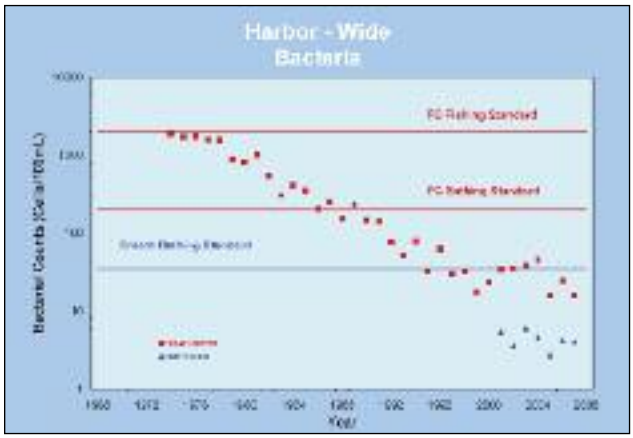
Harbor-wide water quality trends for 2007 showed improvement in Jamaica Bay and generally retained the status quo in other areas. The open waters of the harbor have remained stable with slight fluctuations attributed to weather and sampling density for the last several years.

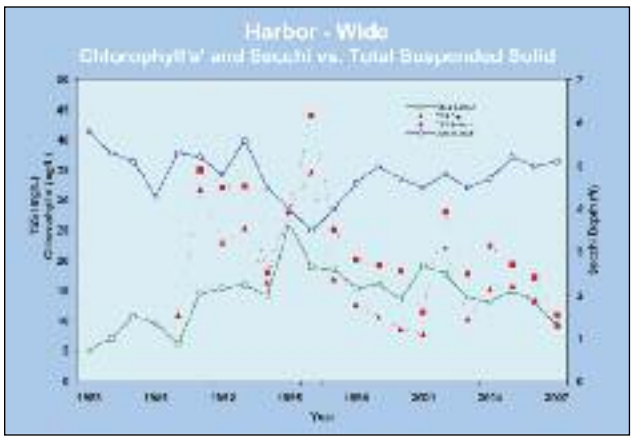
The largest fluctuation occurred in Jamaica Bay with Chlorophyll 'a'. Data collected in 2007 showed approximately a 40% drop in Chlorophyll 'a' levels during the summer sampling season. This drop comes after four years of relatively stable results, and also drops the average Chlorophyll 'a' levels in Jamaica Bay to the lowest levels since the ban on ocean dumping of sludge in 1992. The causes of this drop are being investigated, and it remains to be seen if this is a continuing trend or just a one year anomaly.

Fecal coliform trends throughout the harbor remain stable. Open water stations all have average values well below bathing standards. Short-term spikes do occur after rain events due to CSO discharges. Enterococcus sampling over the last six years has shown relatively stable average values, with spikes similar in size and frequency to the fecal levels. As with the fecal averages, the enterococcus averages for open waters remain well below bathing standards. The NYC DEP's Long Term Control Plan (LTCP) is underway and has begun addressing short-term spikes caused by CSOs and stormwater runoff.

Dissolved oxygen levels showed a slight decrease harbor-wide, with the average value remaining above the Bathing standard (harbor wide). The Upper East River is the only area in which the average values are below the bathing standard, but all open waters of the harbor do remain, on average, above their waterbody classification.

The Harbor Survey has begun a long-term analysis of linkages between wet weather and our water quality measurements. (Preliminary results may be available in the 2008 Report.) The Survey has also begun its integration into the LTCP. Stations in the East River (Flushing Bay and Creek) and Jamaica Bay (Spring Creek) have been added to our regular sampling rotation. Other waterbodies will be added until 70 stations a week are sampled by the Survey, when fully integrated.

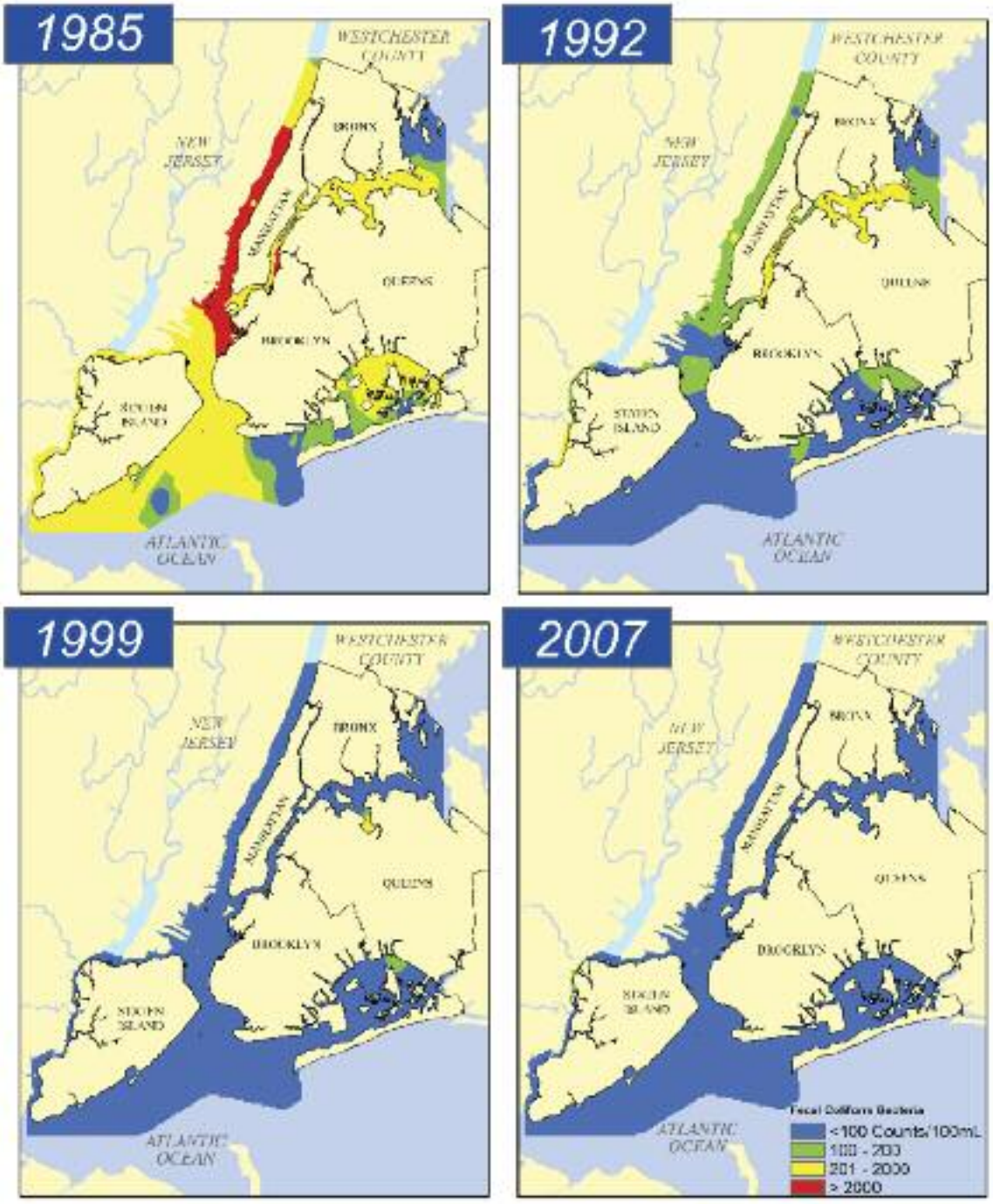




Overall water quality throughout the harbor exceeds standards the vast majority of the time. Short-term spikes are present after some rain events. The City of New York through the LTCP is committed to addressing these spikes and is working towards a goal of having all open waters throughout the harbor meeting fishing and bathing standards at all times.

Harbor-Wide Water Quality Improvements Over Four Time Periods

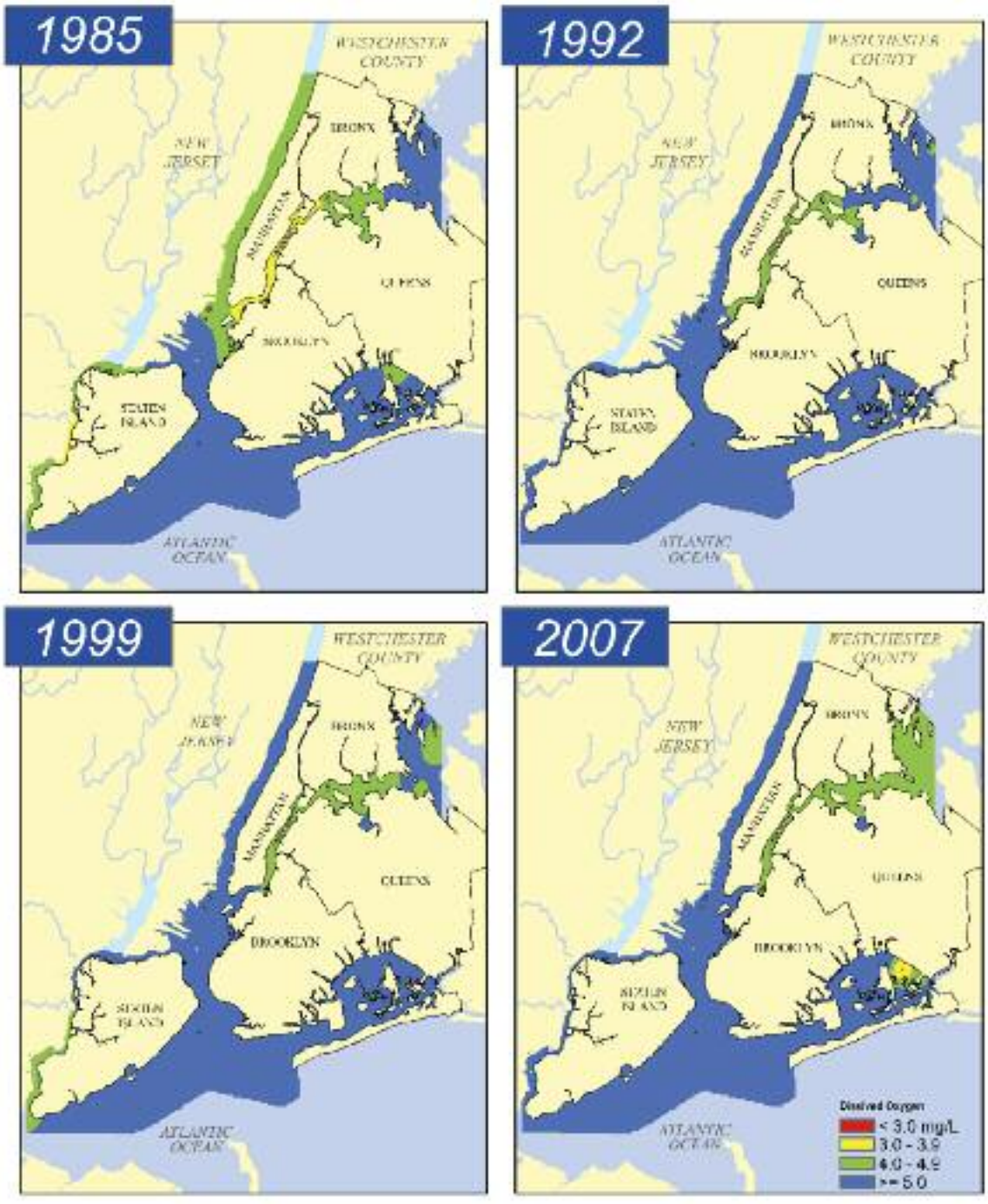
SUMMER GEOMETRIC MEANS FOR
FECAL COLIFORM IN SURFACE WATERS



NYS Best-Use Classifications: ≤ 200 FC/100 mL=SB (Bathing); ≤ 2000 FC/100 mL=I (Fishing).
NYC DOH requirements preclude bathing near sewer outfalls and where rainfall may substantially increase coliform levels.

Harbor-Wide Water Quality Improvements Over Four Time Periods

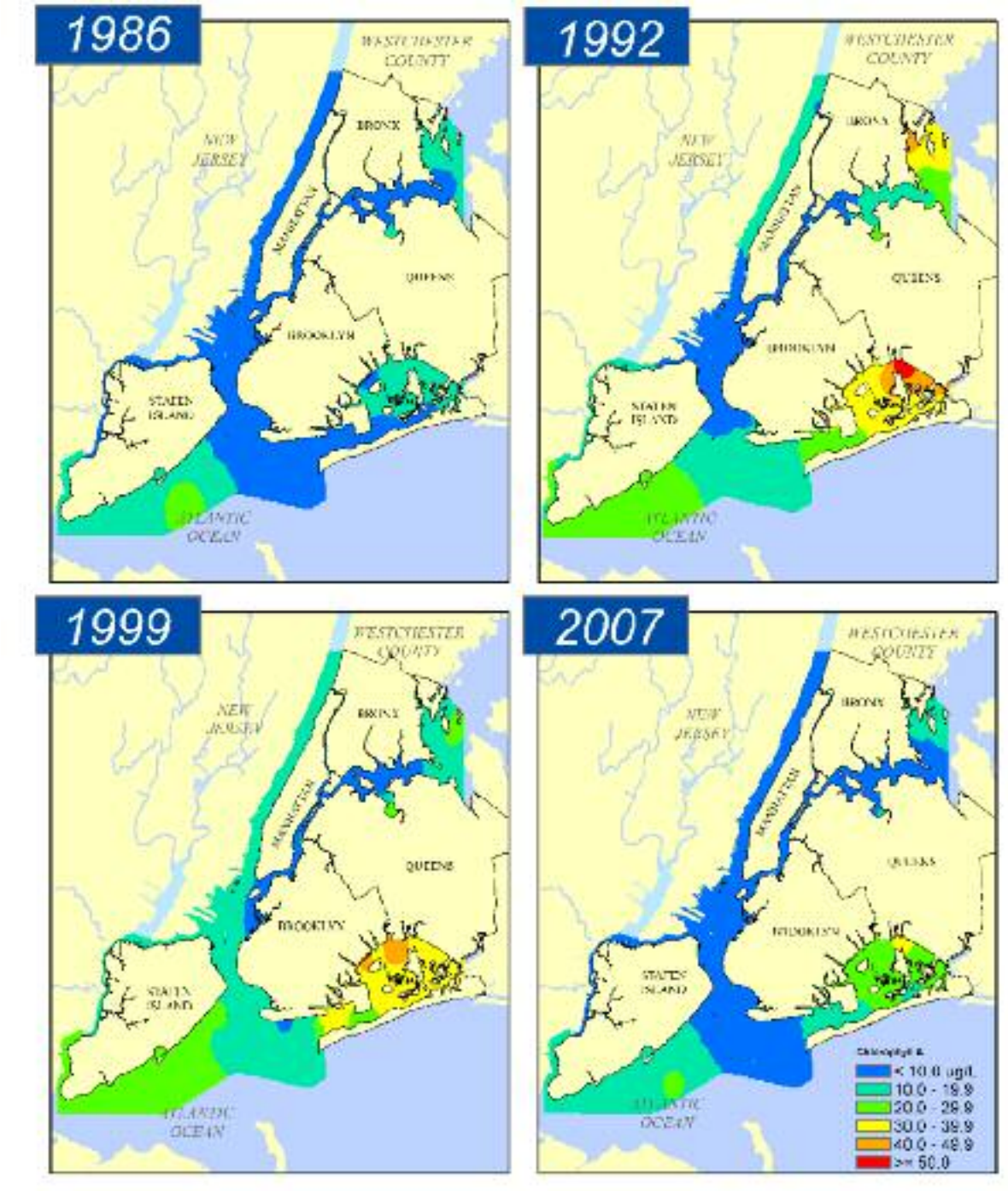
SUMMER AVERAGES FOR
DISSOLVED OXYGEN IN BOTTOM WATERS



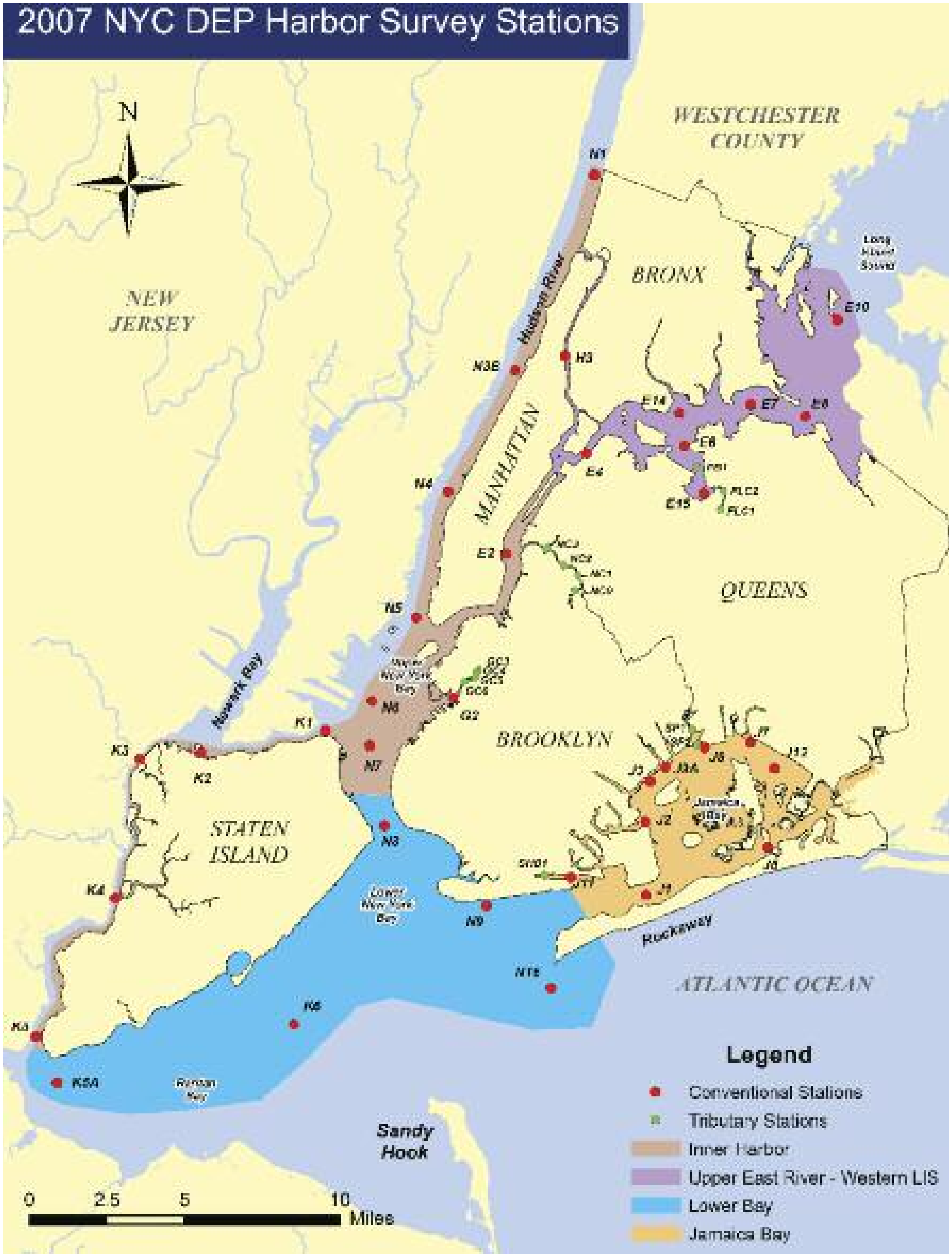
NYS Best-Use Classifications: DO >5 mg/L=SB (Bathing); DO >4 mg/L=I (Fishing); DO >3 mg/L=SD (Fish Survival)

Harbor-Wide Water Quality Improvements Over Four Time Periods

SUMMER AVERAGES FOR
CHLOROPHYLL 'a' IN SURFACE WATERS



Chlorophyll 'a' >20 ug/L = Eutrophic conditions


2007 NYC DEP Harbor Survey Stations
N
WESTCHESTER COUNTY
BRONX
NEW JERSEY
MANHATTAN
QUEENS
BROOKLYN
STATEN ISLAND
Hudson River
Newark Bay
Rockaway
ATLANTIC OCEAN
Sandy Hook
Legend
Conventional Stations
Tributary Stations
Inner Harbor
Upper East River - Western LIS
Lower Bay
Jamaica Bay
0 2.5 5 10
Miles


NYCDEP Water Pollution Control Plants and CSOs
N
WESTCHESTER COUNTY
NEW JERSEY
BRONX
MANHATTAN
QUEENS
BROOKLYN
STATEN ISLAND
ATLANTIC OCEAN
North River
Hunts Point
Wards Island
Bowery Bay
Tallman Island
Newtown Creek
Red Hook
26th Ward
Jamaica
Owls Head
Port Richmond
Coney Island
Rockaway
Oakwood Beach
0 2.5 5 10 Miles
23 - 50
51 - 100
101 - 150
151 - 200
201 - 250
CSO Outfalls

Acknowledgments

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The personnel responsible for the Harbor Survey from the Marine Sciences Section included: Section Chief Beau Ranheim, Bernadette Boniecki, Markus Koelbl, William Lopez, Dan Marcktell, Carrie Munill, Andrew Owens, Yin Ren, Naji Yao and Jiye Zhang. Fay Jacques and Veronica Rodriquez from the Support Section also assisted.

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This Summary was revised by Naji Yao, Yin Ren, Bernadette Boniecki, Dan Marcktell, Markus Koelbl, William Lopez, Jiye Zhang and Beau Ranheim.

Photos on page 17, 18 are credited to Don Riepe/ Jamaica Bay Guardian. Other photos taken by: Scott Foster, NYCDEP Photographer, Beau Ranheim and Marine Sciences Section personnel.

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